What is claimed is:

1. A polymerizable dental composition suitable for use in the oral environment comprising:

an ethylenically unsaturated compound;

a dental additive; and

an initiator system comprising an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

2. The polymerizable dental composition of claim 1 wherein the dental additive is selected from the group consisting of fluoride sources, whitening agents, anticaries agents (e.g., xylitol), remineralizing agents (e.g., calcium phosphate compounds), enzymes, breath fresheners, anesthetics, clotting agents, acid neutralizers, chemotherapeutic agents, immune response modifiers, medicaments, indicators, dyes, pigments, wetting agents, surfactants, buffering agents, viscosity modifiers, thixotropes, fillers, polyols, antimicrobial agents, antifungal agents, stabilizers, agents for treating xerostomia, desensitizers, and combinations thereof.

3. The polymerizable dental composition of claim 1 wherein the dental additive is a photobleachable dye.

4. The polymerizable dental composition of claim 1 wherein the composition is in a form selected from the group consisting of a dispersion, a suspension, an emulsion, a solution, and combinations thereof.

5. The polymerizable dental composition of claim 1 wherein the composition is a primer, a dental adhesive, an orthodontic adhesive, a coating, a sealant, a cement, a restorative, or combinations thereof.

6. The polymerizable dental composition of claim 1 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

7. The polymerizable dental composition of claim 6 wherein the sensitizer is selected from the group consisting of camphorquinone, benzil, furil, 3,3,6,6-tetramethylcyclohexanedione, phenanthraquinone, 1-phenyl-1,2-propanedione, and combinations thereof.

8. The polymerizable dental composition of claim 1 wherein the initiator system further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

9. The polymerizable dental composition of claim 8 wherein the electron acceptor is an iodonium salt, a hexaarylbisimidizole, a persulfate, a peroxide, a metal ion in an oxidized state, or combinations thereof.

10. The polymerizable dental composition of claim 8 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

11. The polymerizable dental composition of claim 1 wherein the initiator system further comprises a reducing agent different from the arylsulfinate salt.

12. A polymerizable composition comprising:

an ethylenically unsaturated compound; and

an initiator system comprising an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group,

wherein the polymerizable composition is a dental material suitable for use in the oral environment.

13. The polymerizable composition of claim 12 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

14. The polymerizable composition of claim 12 wherein the initiator system further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

15. The polymerizable composition of claim 14 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

16. The polymerizable composition of claim 12 wherein the initiator system further comprises a reducing agent different from the arylsulfinate salt.

17. The polymerizable composition of claim 12 further comprising a photobleachable dye.

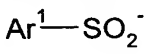
18. A method of hardening a composition comprising irradiating a polymerizable dental composition comprising:

an ethylenically unsaturated compound;

a dental additive;

a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers; and

an arylsulfinate salt having an anion of Formula I



I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

19. The method of claim 18 wherein the sensitizer is selected from the group consisting of camphorquinone, benzil, furil, 3,3,6,6-tetramethylcyclohexanedione, phenanthraquinone, 1-phenyl-1,2-propanedione, and combinations thereof.

20. The method of claim 18 wherein the polymerizable dental composition further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

21. A method of hardening a composition comprising:

combining components to form a hardenable dental composition; and

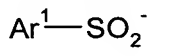
allowing the dental composition to harden, wherein the components comprise:

an ethylenically unsaturated compound;

a dental additive;

an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode; and

an arylsulfinate salt having an anion of Formula I



I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

22. The method of claim 21 wherein the electron acceptor is an iodonium salt, a hexaarylbisimidizole, a persulfate, a peroxide, a metal ion in an oxidized state, or combinations thereof.

23. The method of claim 21 wherein the components further comprise a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

24. The method of claim 23 wherein the method further comprises irradiating the hardenable dental composition.

25. A method of treating a dental structure surface comprising:

applying a hardenable dental composition to the dental structure surface; and

irradiating the dental composition,

wherein the hardenable dental composition comprises:

an ethylenically unsaturated compound;

a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers; and

an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

26. The method of claim 25 wherein the hardenable dental composition further comprises a dental additive.

27. The method of claim 25 wherein the sensitizer is selected from the group consisting of camphorquinone, benzil, furil, 3,3,6,6-tetramethylcyclohexanedione, phenanthraquinone, 1-phenyl-1,2-propanedione, and combinations thereof.

28. The method of claim 25 wherein the hardenable dental composition further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

29. A method of treating a dental structure surface comprising:

applying a hardenable dental composition to the dental structure surface; and

allowing the hardenable dental composition to harden,

wherein the dental composition comprises:

an ethylenically unsaturated compound;

an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode; and

an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

30. The method of claim 29 wherein the hardenable dental composition further comprises a dental additive.

31. The method of claim 29 wherein the electron acceptor is an iodonium salt, a hexaarylbisimidizole, a persulfate, a peroxide, a metal ion in an oxidized state, or combinations thereof.

32. The method of claim 29 wherein the hardenable dental composition further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

33. The method of claim 32 wherein the method further comprises irradiating the hardenable dental composition.

34. A self-etching, polymerizable dental composition comprising:

an ethylenically unsaturated compound with acid functionality;

an ethylenically unsaturated compound without acid functionality; and

an initiator system comprising an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

35. The self-etching, polymerizable dental composition of claim 34 wherein the composition is a primer, a dental adhesive, an orthodontic adhesive, a coating, a sealant, a cement, a restorative, or combinations thereof.

36. The self-etching, polymerizable dental composition of claim 34 wherein the composition is non-aqueous.

37. The self-etching, polymerizable dental composition of claim 34 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

38. The self-etching, polymerizable dental composition of claim 34 wherein the initiator system further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

39. The self-etching, polymerizable dental composition of claim 38 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

40. The self-etching, polymerizable dental composition of claim 34 wherein the composition further comprises a filler.

41. The self-etching, polymerizable dental composition of claim 40 wherein the filler is a nanofiller.

42. The self-etching, polymerizable dental composition of claim 34 wherein the acid functionality comprises carboxylic acid functionality, phosphoric acid functionality, sulfonic acid functionality, or combinations thereof.

43. The self-etching, polymerizable dental composition of claim 34 further comprising a photobleachable dye.

44. A self-etching, polymerizable dental composition comprising:

an ethylenically unsaturated compound with acid functionality;

an ethylenically unsaturated compound without acid functionality

a surfactant;

water; and

an initiator system comprising an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group,

wherein the self-etching, polymerizable dental composition is an emulsion.

45. The self-etching, polymerizable dental composition of claim 44 wherein the emulsion is a water-in-oil emulsion.

46. The self-etching, polymerizable dental composition of claim 44 wherein the emulsion is physically stable.

47. The self-etching, polymerizable dental composition of claim 44 wherein the composition comprises less than 30% by weight water.

48. The self-etching, polymerizable dental composition of claim 44 wherein the composition is a water-in-oil micro-emulsion.

49. The self-etching, polymerizable dental composition of claim 44 wherein the composition further comprises a filler.

50. The self-etching, polymerizable dental composition of claim 49 wherein the filler is a nanofiller.

51. The self-etching, polymerizable dental composition of claim 44 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

52. The self-etching, polymerizable dental composition of claim 44 wherein the initiator system further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

53. The self-etching, polymerizable dental composition of claim 52 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

54. The self-etching, polymerizable dental composition of claim 44 further comprising a photobleachable dye.

55. A self-adhesive, polymerizable dental composition comprising:
an ethylenically unsaturated compound with acid functionality;
an ethylenically unsaturated compound without acid functionality;
at least 40% by weight filler; and
an initiator system comprising an arylsulfinate salt having an anion of Formula I

$$Ar^1—SO_2^-$$

I

and a cation having a positively charged nitrogen atom or a positively charged phosphorus atom, wherein the arylsulfinate salt has an oxidation potential in N,N-dimethylformamide of 0.0 to +0.4 volts versus a silver/silver nitrate reference electrode, and wherein Ar^1 is a C_{6-30} aryl or a C_{3-30} heteroaryl that is unsubstituted or substituted with an electron withdrawing group or an electron withdrawing group in combination with an electron donating group.

56. The self-adhesive, polymerizable dental composition of claim 55 wherein the composition is non-aqueous.

57. The self-adhesive, polymerizable dental composition of claim 55 wherein the acid functionality comprises carboxylic acid functionality, phosphoric acid functionality, sulfonic acid functionality, or combinations thereof.

58. The self-adhesive, polymerizable dental composition of claim 55 wherein the filler is a nanofiller.

59. The self-adhesive, polymerizable dental composition of claim 55 further comprising a photobleachable dye.

60. The self-adhesive, polymerizable dental composition of claim 55 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.

61. The self-adhesive, polymerizable dental composition of claim 55 wherein the initiator system further comprises an electron acceptor having a reduction potential in N,N-dimethylformamide of +0.4 to –1.0 volts versus a silver/silver nitrate reference electrode.

62. The self-adhesive, polymerizable dental composition of claim 61 wherein the initiator system further comprises a sensitizer capable of absorbing a wavelength of actinic radiation in the range of 250 to 1000 nanometers.